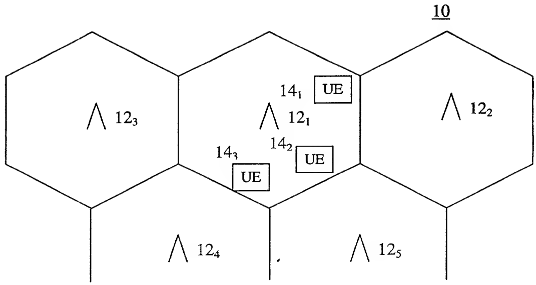
10
14_1
UE
12_3
12_1
12_2
14_2
UE
14_3
UE
12_4
12_5

FIG. 1

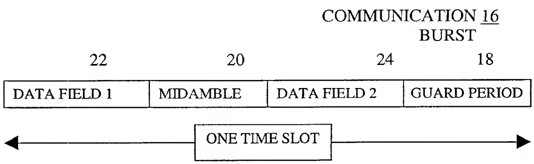
COMMUNICATION 16
BURST
22
20
24
18
DATA FIELD 1
MIDAMBLE
DATA FIELD 2
GUARD PERIOD
ONE TIME SLOT

FIG. 3

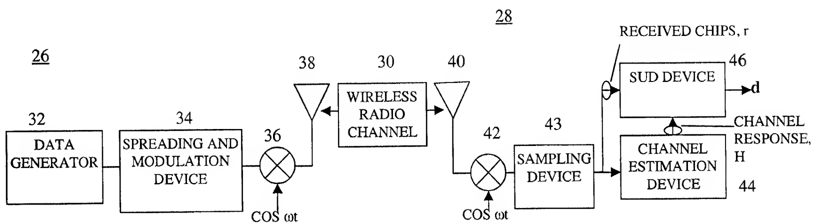
28
26
RECEIVED CHIPS, r
38
30
40
46
SUD DEVICE
d
WIRELESS
RADIO
CHANNEL
32
34
CHANNEL
RESPONSE,
H
36
42
43
DATA
GENERATOR
SPREADING AND
MODULATION
DEVICE
SAMPLING
DEVICE
CHANNEL
ESTIMATION
DEVICE
44
COS ωt
COS ωt

Fig. 2

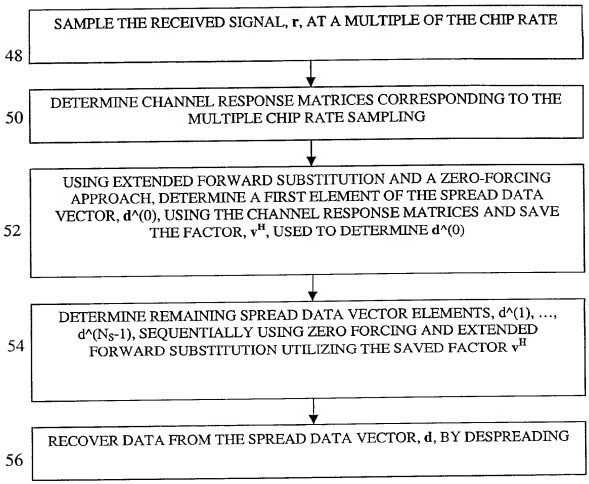
SAMPLE THE RECEIVED SIGNAL, r, AT A MULTIPLE OF THE CHIP RATE
48
DETERMINE CHANNEL RESPONSE MATRICES CORRESPONDING TO THE MULTIPLE CHIP RATE SAMPLING
50
USING EXTENDED FORWARD SUBSTITUTION AND A ZERO-FORCING APPROACH, DETERMINE A FIRST ELEMENT OF THE SPREAD DATA VECTOR, d^(0), USING THE CHANNEL RESPONSE MATRICES AND SAVE THE FACTOR, v^H, USED TO DETERMINE d^(0)
52
DETERMINE REMAINING SPREAD DATA VECTOR ELEMENTS, d^(1), ..., d^(N_S-1), SEQUENTIALLY USING ZERO FORCING AND EXTENDED FORWARD SUBSTITUTION UTILIZING THE SAVED FACTOR v^H
54
RECOVER DATA FROM THE SPREAD DATA VECTOR, d, BY DESPREADING
56

FIG. 4

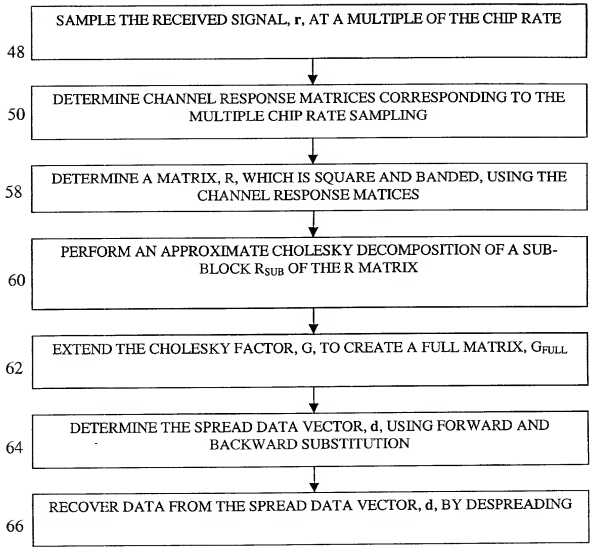
SAMPLE THE RECEIVED SIGNAL, r, AT A MULTIPLE OF THE CHIP RATE
48
DETERMINE CHANNEL RESPONSE MATRICES CORRESPONDING TO THE MULTIPLE CHIP RATE SAMPLING
50
DETERMINE A MATRIX, R, WHICH IS SQUARE AND BANDED, USING THE CHANNEL RESPONSE MATICES
58
PERFORM AN APPROXIMATE CHOLESKY DECOMPOSITION OF A SUB-BLOCK R_{SUB} OF THE R MATRIX
60
EXTEND THE CHOLESKY FACTOR, G, TO CREATE A FULL MATRIX, G_{FULL}
62
DETERMINE THE SPREAD DATA VECTOR, d, USING FORWARD AND BACKWARD SUBSTITUTION
64
RECOVER DATA FROM THE SPREAD DATA VECTOR, d, BY DESPREADING
66

FIG. 5

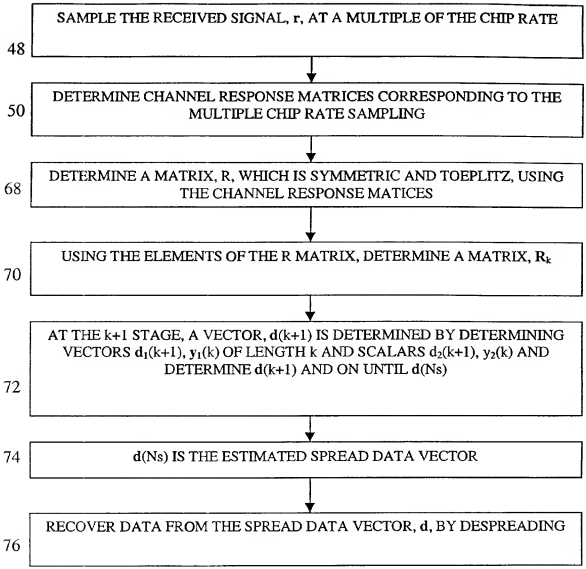

FIG. 6

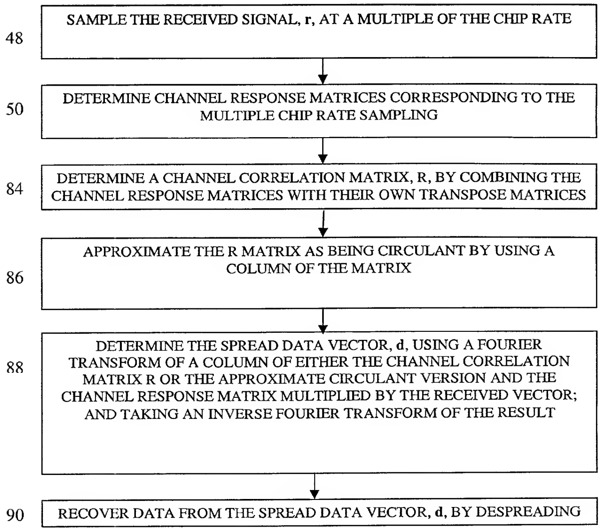
48
SAMPLE THE RECEIVED SIGNAL, r, AT A MULTIPLE OF THE CHIP RATE
50
DETERMINE CHANNEL RESPONSE MATRICES CORRESPONDING TO THE MULTIPLE CHIP RATE SAMPLING
84
DETERMINE A CHANNEL CORRELATION MATRIX, R, BY COMBINING THE CHANNEL RESPONSE MATRICES WITH THEIR OWN TRANSPOSE MATRICES
86
APPROXIMATE THE R MATRIX AS BEING CIRCULANT BY USING A COLUMN OF THE MATRIX
88
DETERMINE THE SPREAD DATA VECTOR, d, USING A FOURIER TRANSFORM OF A COLUMN OF EITHER THE CHANNEL CORRELATION MATRIX R OR THE APPROXIMATE CIRCULANT VERSION AND THE CHANNEL RESPONSE MATRIX MULTIPLIED BY THE RECEIVED VECTOR; AND TAKING AN INVERSE FOURIER TRANSFORM OF THE RESULT
90
RECOVER DATA FROM THE SPREAD DATA VECTOR, d, BY DESPREADING

FIG. 7

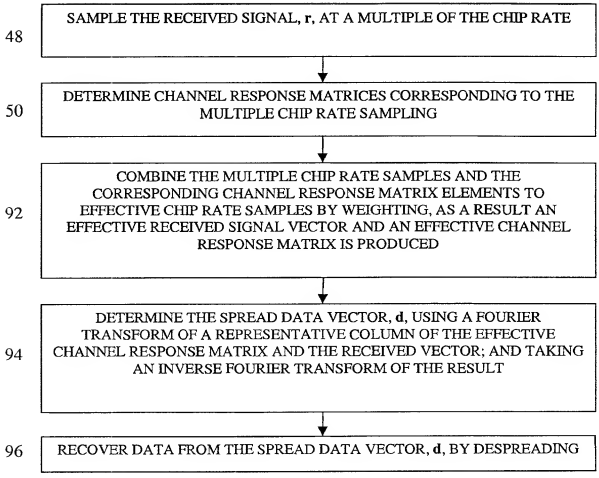
48
SAMPLE THE RECEIVED SIGNAL, r, AT A MULTIPLE OF THE CHIP RATE
50
DETERMINE CHANNEL RESPONSE MATRICES CORRESPONDING TO THE MULTIPLE CHIP RATE SAMPLING
92
COMBINE THE MULTIPLE CHIP RATE SAMPLES AND THE CORRESPONDING CHANNEL RESPONSE MATRIX ELEMENTS TO EFFECTIVE CHIP RATE SAMPLES BY WEIGHTING, AS A RESULT AN EFFECTIVE RECEIVED SIGNAL VECTOR AND AN EFFECTIVE CHANNEL RESPONSE MATRIX IS PRODUCED
94
DETERMINE THE SPREAD DATA VECTOR, d, USING A FOURIER TRANSFORM OF A REPRESENTATIVE COLUMN OF THE EFFECTIVE CHANNEL RESPONSE MATRIX AND THE RECEIVED VECTOR; AND TAKING AN INVERSE FOURIER TRANSFORM OF THE RESULT
96
RECOVER DATA FROM THE SPREAD DATA VECTOR, d, BY DESPREADING

FIG. 8

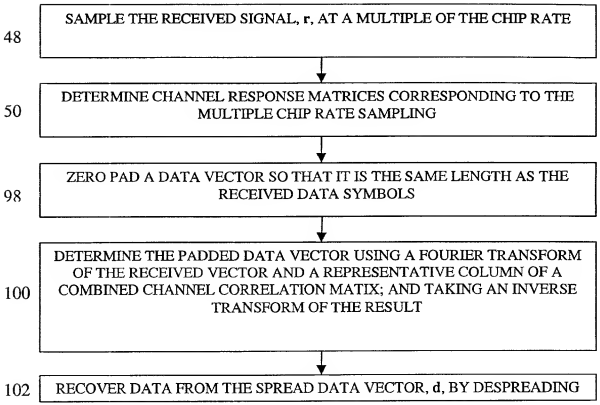

FIG. 9